forms of echinoid larvæ. Mr. J. Parkinson worked at the variation of species of *Cardium*, *Donax*, and *Tellina*. The object of Mr. Vernon's interesting work was to determine how the nitrogenous matter excreted by marine animals into the water is removed, and what parts the various forms of vegetable life and other agencies play in the process. Bacteria are of importance. It was found that the pipes conducting the water from the reservoirs to the rooms were coated internally with a layer of bacterial slime, and that in its passage along these pipes the water underwent considerable purification. Probably in marine aquaria a more powerful purifying influence than the bacterial is exerted by the diatoms and minute algæ.

An interim report was presented by the Committee on Bird Migration in Great Britain; and the Rev. T. R. R. Stebbing discussed the report of the International Zoological Congress on Nomenclature.

The final report of the Oyster Committee was presented by Prof. W. A. Herdman, who gave an account, illustrated by lantern slides, of the chief conclusions arrived at. The report ends with the following recommendations:—

(*a*) That the necessary steps should be taken to induce the oyster trade to remove any possible suspicion of sewage contamination from the beds and layings from which oysters are supplied to the market. This could obviously be effected in one of two ways, either (1) by restrictive legislation and the licensing of beds only after due inspection by the officials of a Government Department, or (2) by the formation of an association amongst the oyster-growers and dealers themselves, which should provide for the due periodic examination of the grounds, stores and stock, by independent properly qualified inspectors. Scientific assistance and advice given by such independent inspectors would go far to improve the condition of the oyster beds and layings, to reassure the public, and to elevate the oyster industry to the important position which it deserves to occupy.

(*b*) Oysters imported from abroad (Holland, France, or America) should be consigned to a member of the Oyster Association, who should be compelled by the regulations to have his foreign oysters as carefully inspected and certificated as those from his home layings. A large proportion of the imported oysters are, however, deposited in our waters for such a period before going to market that the fact of their having originally come from abroad may be ignored. If this period of quarantine were imposed upon all foreign oysters, a great part of the difficulty as to inspection and certification would be removed.

(*c*) The grounds from which mussels, cockles and periwinkles are gathered should be periodically examined by scientific inspectors in the same manner as the oyster beds. The duty of providing for this inspection might well, we should suggest, be assumed by the various Sea Fisheries Committees around the coast.

Dr. H. Lyster Jameson exhibited examples of a race of protectively coloured mice that inhabit a sandy island in the Bay of Dublin, known as the North Bull. A considerable percentage of these mice are distinctly lighter in colour than the ancestral type (*Mus musculus*, Linn.). Every possible intergradation, however, occurs between the typical house mouse and the palest examples. Mr. Jameson considers the marked predominance of sand-coloured examples as due to the action of natural selection. The hawks and owls, which frequent the island and hunt by "sight," are the only enemies the mice have to compete against, and they most easily capture the darkest mice; that is to say, the mice that contrast most strikingly with the colour of the sand; and thus by the weeding out of the dark-coloured examples a protectively coloured race is becoming established, which, however, has not yet settled down into the comparative stability which usually characterises species.

A reference to old charts and Parliamentary papers has shown that this island first came into existence about a century ago; consequently it is in this case possible to fix a time limit within which the race in question has been evolved.

Monday, September 12.—The Section opened with an interesting account, by Prof. Poulton and Miss C. B. Sanders, of an experimental inquiry into the struggle for existence in certain common insects. A large number of lepidopterous pupæ were exposed under various conditions at Oxford, in Switzerland, and in the Isle of Wight, in order to test by experiment the amount of destruction by birds and other enemies, and also to determine what amount of protection was afforded by coloration. The results showed that there is a heavy death-rate in the pupal condition, and apparently that there is a greater destruction of pupæ at Oxford than in Switzerland. An interesting discussion followed, in which Sir John Lubbock, Prof. Lankester and Prof. Meldola took part. Miss Sanders described and demonstrated with specimens the actual details of the experiments and observations.

Prof. Lloyd Morgan followed with a paper on animal intelligence as an experimental study, which dealt largely with the results of Mr. Thorndike's experiments in America with cats. It was shown that the cats, in opening the doors of ingeniously devised cages, learned gradually by experience, and were not able to profit by imitation. This performance of purposive acts, learned as the result of chance experience, was characterised as intelligent in contradistinction to rational. Prof. Morgan expressed the opinion that without the record of the genesis of an intelligent action observation and anecdote of animal intelligence are of little importance; and in answer to Sir John Lubbock, and others who spoke in the discussion, he stated that the advantage of simple experiments, such as those of Thorndike, over observations, is that the results can be readily expressed in curves.

Dr. A. J. Harrison read a paper on his own observations in the Clifton Zoological Gardens, on the so-called fascination of snakes. The animals dealt with were pythons, both adult and young; and it was shown that in captivity, at least, there was no evidence that they possessed the power of fascinating their living prey, such as hens, ducks and rabbits.

Prof. O. C. Marsh gave a paper on those families of the Dinosauria, which he has called Sauropoda—such as Ceteosaurus and its allies—upon which he has a memoir ready for publication.

Dr. Masterman read a paper by Prof. McIntosh on the scientific experiments to test the effects of trawling in the waters of Scotland from 1886 to 1897. The areas dealt with were St. Andrews Bay, the Firth of Forth, and the Moray Firth, and Prof. McIntosh gave his reasons for dissenting from the conclusion drawn from the work of the Fishery Board for Scotland that the closure of areas against trawlers had led to an increase in the fish population.

The remaining papers were:—A new theory of retrogression, by Mr. G. A. Reid; the structure of nerve cells, by Dr. G. Mann; and a circulating apparatus for use in researches on colour physiology and other purposes, by Messrs. F. W. Gamble and W. F. Keeble.

Tuesday, September 13.—The following papers were taken:—Mr. R. I. Pocock, on musical organs in spiders; Dr. A. T. Masterman, on the origin of the vertebrate notochord and pharyngeal clefts; Prof. Ch. Julin, on "Le développement du cœur chez les Tuniciers—quelques considérations sur la phylogénie des Ascidies simples"; Mr. W. E. Hoyle, on Dr. Field's card-catalogue of zoological literature; Mr. F. A. Bather, on the classification of the Pelmatozoa; Prof. A. B. Macallum, on the detection of phosphorus in tissues; and two reports of Committees, one on the physiological effects of peptone and its precursors when introduced into the circulation, and the other on the exploration of caves in the Malay Peninsula.

Prof. Julin in his paper dealt with the formation of the heart from the epicardium and its homology with the stolon. He showed reasons for regarding *Distaplia* as a central form linking the other compound ascidians to the simple ascidians through the Clavelinidæ.

The Peptone Committee report that their experiments make it appear probable that peptones and albumenoses are not wholly foreign substances to the circulating blood. It is, however, uncertain to what extent any given substance introduced into the circulation is again recoverable from the urine, and how long such substances can retain their identity after being so introduced. Anti-peptone seems to remain in the system to a much greater extent than any of the other substances employed.

As Section I did not meet this year, but was supposed to be incorporated with D, several of the papers and reports—such as the one last mentioned—were of a physiological nature.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

THE Geographical Section at Bristol was as a rule well attended, and on one occasion crowded; but, as happens too frequently, the audience had a tendency to vary inversely as the scientific value of the communications submitted to it. Yet on the whole the twenty-five papers read were of high quality, and some of them represented original work in research as well as in travel. The President, Colonel George Earl

Church, formerly of the United States Army, gave an address full of original observations on the central parts of South America, in the course of which he traced the origin of the main features of that continent. This address as printed is enriched with a series of maps and diagrams.

Seven important papers were read on various branches of physical geography, most of them being illustrated by lantern slides. Mr. Vaughan Cornish discussed wave-forms, giving the preliminary results of a research in which he is engaged on the phenomena of waves in water, air, and drifted sand. The results were made clear by a large number of carefully selected photographs and diagrams.

Mr. H. N. Dickson gave a brief account of his work on the salinity and temperature of the North Atlantic, which promises to produce results of great value. His paper described the first results of a discussion of observations of surface temperature made in the North Atlantic, during the two complete years 1895 and 1896, by the captains and officers of merchant ships. The captains of a number of the vessels also collected daily samples of surface water, and the densities of these, numbering about 5000 in all, have been determined by chlorine titration. The material has been found sufficient to allow of the construction of charts showing the distribution of temperature and salinity over a large part of the area during each of the twenty-four consecutive months. The series, which is the first of its kind, shows the progressive changes in the manner of synoptic charts, and provides the data necessary for extending the work recently done in and around the North Sea, in connection with sea-fisheries and long-period weather forecasting. Specimens of the maps were shown on the screen.

Dr. K. Natterer, of Vienna, submitted the oceanographical results of the Austro-Hungarian Deep-Sea Expeditions in the Eastern Mediterranean, Sea of Marmora, and Red Sea. He referred especially to his own chemical observations and the deductions made from them. Of these the most striking was the presumption that the salt-deposits of arid regions surrounding a deep sea were due to the evaporation of sea-water raised by capillarity through the substance of the rocks.

A report by Mr. E. G. Ravenstein was presented on behalf of the Committee for the investigation of the climatology of Africa. The efforts of this Committee during the last seven years have resulted in inducing a number of the African colonial governments to institute regular meteorological observations, and the Committee feels that it is no longer necessary to supply instruments to unofficial observers, although several of the sets supplied to missionaries and others have led to the compilation of important records.

Dr. J. W. Gregory discussed the theory of the arrangement of oceans and continents on the earth's surface in the light of geological and physical observations, He pointed out that Elie de Beaumont's famous scheme attached undue importance to linear symmetry and was too artificial. It led, however, to the tetrahedral theory of Lowthian Green, which regards the world, not as shaped like a simple tetrahedron, but as a spheroid slightly flattened on four faces. Such flattenings occur on hollow, spherical shells, when they are deformed by uniformly distributed external pressure. The oceans would occupy the four depressions thus produced, and the land masses occur at the angles and along the edges. The existing geographical arrangement is in general agreement with this scheme; for as the tetrahedron is hemihedral the assumption that the lithosphere is tetrahedral explains the antipodal position of land and water, the excess of water in the southern hemisphere, and the southward tapering of the land masses. The main lines of the existing system of fold-mountains have a general agreement with the arrangement of the edges of a tetrahedron. Some striking deviations occur, but are explicable by the variations in the composition of the lithosphere, and the existence of impassive blocks of old strata which have moulded the later movements. The lines of the old fold-mountains of the Hercynian system may have been tetrahedrally arranged, with the axes occupying different positions from those of the great Cainozoic mountain system. So far, however, there is no completely satisfactory theory of geomorphology, for which we must wait for further information as to the distribution of land and water in successive epochs of the world's history.

Two important papers on earthquake phenomena were read—one by Prof. J. Milne, F.R.S., on the methods and utility of seismological research; the other by Mr. R. D. Oldham, on the great Indian earthquake of June 12, 1897, which was the largest and, with a few possible exceptions, the most violent of which there is any record. The area over which the shock was sensible was not less than 1,750,000 square miles, while the focus occupied an area of 200 miles in length and 50 miles in width. Landslips on an unprecedented scale were produced in the Garo and Khasia hills, and in the Himalayas north of Lower Assam. A number of lakes have been produced by changes of level due to the earth-movements by which the earthquake was caused, and the mountain peaks have been moved both vertically and horizontally. Monuments of solid stone and forest trees have been broken across by the violence of the shaking they have received. Communications of all kinds were interrupted; bridges were overthrown, displaced, and in some cases thrust bodily upwards to a height of as much as 20 feet, while the rails on the railways were twisted and bent. Earth fissures were formed over an area larger than the United Kingdom, and sand rents, from which sand and water were forced in solid streams to a height of 3 to 5 feet above the ground, were opened in incalculable numbers.

Dr. J. Scott Keltie in a short paper on "political geography" laid stress on the way in which natural conditions determined the manner of the relations between land and people, and showed how changing economic conditions produced corresponding changes in political geography, *e.g.* the formation of such forms as spheres of influence and leased territories. A paper by Mr. G. G. Chisholm, on the impending economic revolution in China, enforced by a concrete instance of great practical importance some of the theoretical considerations brought forward by Dr. Keltie.

Mr. H. T. Crook, of Manchester, criticised the methods of selecting place-names for the Ordnance Survey Map, and brought forward several errors in the sheets of the new one-inch map of the Manchester district. The paper gave rise to a lively discussion, in which Mr. G. F. Deacon supported the contention of the author; while Colonel Farquharson and Sir Charles Wilson, the present and late Directors-General of the Survey, fully explained the methods employed and showed the enormous difficulties with which the whole question of place-names is surrounded. They stated that the Survey always welcomed criticism, and that corrections were frequently made on the plates as the result of information sent by people in the localities when mistakes occurred. It was suggested that the public could aid in the production of good maps more effectually by communicating with the Survey Office than by writing critical articles in the press.

A group of papers submitted to the Section dealt with geographical developments of the future. Prof. Reclus brought forward his scheme for a great terrestrial globe on the scale of 1 : 500,000, or about 84 feet in diameter. The surface of this globe should exhibit the relief of the lithosphere on a true scale, and separate plates of it would be available for use as relief maps upon a surface showing the natural curvature. M. Reclus spoke with great eloquence of the scientific and educational advantages of his scheme, the initial cost of which, however, could not fall far short of 50,000*l*. In the discussion Sir Richard Temple spoke in support of the work being carried out, and a Committee of Section E was appointed by the General Committee to consider and report upon the scientific value of the proposal.

Prof. Patrick Geddes described an interesting experiment in the practical teaching of geography about to be tried in Edinburgh, where he is fitting up an "outlook tower" or geographical museum of a novel character. Thus the exhibition of the ground-floor centres round a globe with an outline survey of the main concepts of world geography—*e.g.* an incipient collection of maps and illustrative landscapes, an outline of the progress of geographical discovery and of map-making, &c. The first floor is devoted to the geography and history of Europe in correspondingly fuller treatment; the second is set apart for an outline geography and history of the English-speaking world, the United States having a room on the same level as the British Empire. On the third story is preparing a corresponding survey of Scotland, viewed at once as an historic and social entity and as an element of greater nationality; while the fourth story, naturally as yet in the most advanced state of preparation, is a museum of Edinburgh, though again not without comparison with Scottish and other cities. The flat roof bears a turret of culminating outlook with a *camera obscura*. Descending from the roof to the upppermost story, this succession and unity of the physical, organic and social conditions is better understood.

Thus the relief model of the site of Edinburgh brings indispensable light on the interpretation of the antique and the modern city, its military history or its industrial present, its medical eminence or its picturesque interest. Similar regional towers should be erected in all large towns. A tower as a memorial to Cabot was recently opened in Bristol, presenting some features which might be developed on the lines of Prof. Geddes' conceptions, but no reference was made to it at the meeting of Section E, nor was the Section invited to visit the tower.

Ballooning as an aid to geographical exploration was discussed by Captain B. Baden-Powell, of the Scots Guards, who outlined a well-considered scheme for an experimental balloon voyage up the Nile valley, where the meteorological conditions are more favourable than those of the Arctic regions, and the chances of disaster more remote. Mr. Eric Stuart Bruce exhibited a method of flash signalling by means of an electric lamp enclosed in a transparent balloon, which he believes to be of special value in polar exploration.

Dr. H. R. Mill discussed the prospects of Antarctic research, tracing the historical changes of the Antarctic problem, and pointing out that the purely scientific importance of south polar exploration demands co-operation amongst simultaneous expeditions rather than consecutive work. He hoped that the definite refusal of Government to take up the work would now leave the way clear for the immediate organisation of a great expedition by the British nation to co-operate with the German expedition which has been planned for 1900.

While the characteristic of this meeting was undoubtedly the solid value and good discussion of the general papers, it in no way fell short of the meetings of preceding years in the interest and value of the records of personal exploration. Mrs. Bishop gave a remarkable paper describing her recent journey in the Yangtze valley, and summarising the geography of that important region. It was illustrated by a series of unique photographs taken by Mrs. Bishop herself. Mrs. Theodore Bent also contributed a paper describing her visit to Sokotra, in the course of which she made valuable observations. A Committee, with a small grant in aid of the further exploration of Sokotra by Dr. H. O. Forbes, was appointed by the Association.

Sir Charles Wilson gave an address on the Upper Nile region with reference to the re-conquest of the Sudan; and, in the absence through illness of the author, he also read a paper, by Sir T. H. Holdich, on Tirah, which was splendidly illustrated by slides. Mr. C. W. Andrews, of the Natural History Museum, gave a preliminary account of Christmas Island in the Indian Ocean, where he has recently spent the greater part of a year. He found it to be an upraised coral island, the coral limestone resting on a hard foraminiferal limestone, which in turn is based on basalt. The whole island is so densely jungle-clad that it could only be traversed at the rate of one mile per day, every yard having to be cut through the dense undergrowth. Captain G. E. H. Barrett-Hamilton described a recent visit he had made to Karaginski Island and the mainland of northern Kamchatka, and Mr. O. H. Howarth added another to his important series of papers on the exploration of Mexico, dealing on this occasion with a journey from Mazatlan to Durango across the Sierra Madre.

It may be pointed out as a disappointing feature at the meeting, that no effort appears to have been made to place before the Section any account of the remarkable geographical position of Bristol with respect to site, immediate surroundings, or commercial position in the world.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

Mr. W. Beckit Burnie has been appointed to the vacant Senior Demonstratorship in Electrical Engineering at the South-Western Polytechnic, Chelsea. Mr. Burnie has studied at the Nottingham University College; under Prof. Ayrton, at the Central Technical College; and under Prof. Weber, of Zürich.

Dr. M. C. Schuyten, rue van Luppen 31, Anvers, invites teachers who are daily engaged in instructing children to make notes upon the characteristics of the minds of their pupils, and send them to him for incorporation in a work to be published by a special commission upon the psychology of the child from a pedagogic point of view.

The foundation-stone of a new Science and Art School for Deptford was laid in New Cross Road on Saturday. The new school is the result of an amalgamation by the Charity Commissioners of two ancient charities—the Addey and the Stanhope—and the joint school is to be known as the Addey and Stanhope Foundation. The new building will cost for erection 10,000*l.*, and for furniture and fittings about 4000*l.*

A course of twenty-four lectures and practical demonstrations on the theory and practice of photography, by Mr. W. J. Pope and Mr. A. A. Donald, commenced on Friday last at the Goldsmiths' Institute, New Cross. Mr. Pope is giving a course of twenty-eight lectures on metallurgy, and a course of laboratory instruction on methods of water analysis commenced on Wednesday, October 5. The course will extend over twelve evenings, and the students will obtain practice in the chemical methods ordinarily used to ascertain the degree of purity of water and its suitability for various manufacturing and domestic purposes.

In an address delivered to the members of the London School Board on Thursday last, Lord Reay, the Chairman of the Board, remarked: Training in physics is found to be preferable to chemistry, and the laboratories now in construction are, as a rule, so fitted as to be adapted to the teaching of physics rather than for specialised instruction of chemistry. Geography in the past has been taught too mechanically. Map-drawing has been revived and greatly improved, but more attention should be given to physical geography, to the great phenomena of nature, to the laws influencing climate, productiveness of soil, &c. History should be connected with geography, and the lessons should be given in such a manner as to make history and geography illustrate each other.

The Directors of Nobel's Explosives Company, Limited, after consultation with Dr. G. G. Henderson, Freeland Professor of Chemistry in the Glasgow and West of Scotland Technical College, have decided to give a prize tenable under the following conditions: (1) The prize to be 30*l.* and to be known as the "Nobel Company Prize." (2) The prize to be awarded annually, until further notice, to a student in the chemical laboratory of the Technical College, who has passed through the usual course of training in that laboratory, and who, in the opinion of the Professor of Chemistry for the time being, is qualified to prosecute research. (3) The holder of the prize to engage in research work in the chemical laboratory of the Technical College, under the direction of the Professor of Chemistry for the time being, for the period of one academical year. (4) The prize to be awarded by the Professor of Chemistry for the time being. In accepting the gift, the Governors of the College further resolved to grant a free studentship for one year in the laboratory to the Nobel Company's prizeman, thus raising the money value of the prize to about 50*l.* The example of Nobel's Company might profitably be followed by other chemical manufacturers.

The Scotch Education Department has issued a circular in further explanation of the scheme of organised science instruction in various classes of schools recently proposed (see p. 408). The schemes proposed in aid of systematic instruction based upon the teaching of science, or in which science is a predominant element, are two—viz. (1) the scheme for higher grade (science) schools, and (2) the scheme for schools of science defined in the Science and Art Directory. The former is especially designed to apply to secondary departments, which, while possessing a distinct organisation, are connected with schools aided under the Education Code, which possesses the necessary equipment for giving practical instruction in science, and in which the predominant aim is intended to be scientific. It is thought that the scheme provides a course of instruction specially suitable for pupils leaving school at the age of fifteen or sixteen, who will in after life for the most part follow industrial or commercial pursuits. Having regard to the increasing importance of a thorough training in science, especially in large industrial centres, the circular points out that schools of science should by preference